A3840-11.19-F
10/7/88

U.S. Chamber of Commerce
Economic Policy Division

Policy Working Papers

September 1988 *Number 19*

COMPETITIVENESS IS ALIVE, WELL, AND THRIVING IN AMERICA

by

Orawin Velz
Economist

U.S. Chamber of Commerce

Policy Working Papers are published by the Economic Policy Division of the U.S. Chamber of Commerce to inform the American public about relevant economic policy issues. These studies are intended as timely and thought-provoking contributions to the national debate about these issues which are of particular importance to the U.S. business community and the public at large. Permission is granted to quote from this report with appropriate attribution to the Economic Policy Division, Chamber of Commerce of the United States.

EXECUTIVE SUMMARY

"America has lost it dominant position in the global economy." "America no longer has the world's highest standard of living." "Productivity growth is lagging behind that of other countries." "America is one more washed-up nation, declining inevitably from its greatness like other great powers of the past." These are the headlines. These are the myths.

In this policy working paper, the issue of American competitiveness is reexamined. The paper also demonstrates how some reports, such as the one by the Council on Competitiveness, manage to grossly exaggerate the well-being of other countries in comparison to that of the United States, while portraying the U.S. economy in the worst possible light. The paper concludes that, contrary to widespread reports, American competitiveness is resurgent. The American standard of living has never been higher, and the prospect for sustained improvement in the economic well-being of all Americans has never been brighter.

The most important single indicator for competitiveness is the standard of living. In 1987, U.S. real per capita disposable income, adjusted for inflation, was at an all-time high, growing steadily throughout the recovery from the last recession of 1981-82. Improvement in family income has been equally remarkable. Median family income also reached a record level in 1987.

Amazingly, the record on family income growth has been misinterpreted to support the stagnant-standard-of-living thesis. It frequently is reported that median family income only recently rose above the level it had attained in 1979, and is virtually identical to its previous all-time high of 1973. Based on this comparison, it is asserted that the American family's standard of living has not increased significantly in 15 years. Such reports neglect to mention what happened to family income during the economic malaise of the late 1970s and the recessionary aftermath in the early 1980s. After remaining stagnant from 1973 to 1977, median family income plummeted between 1978 and 1982. Since 1982, family income has rebounded at a rate unseen since the prosperous 1960s.

International comparisons of standards of living place this issue in perspective. Compared to other countries, U.S. per capita gross domestic product (GDP) is still far above that of Japan and Europe, including the Scandinavian countries.

U.S. manufacturing productivity growth for the past 5 years reached a postwar record, tripling its rate of the 1970s. Compared to other countries, U.S. manufacturing productivity growth was among the highest. While productivity growth has been on the decline in many other countries, it has been increasing steadily in the United States.

Investment also jumped after 1982 and is the main factor accounting for America's growing productivity. Per employed person, nonresidential gross fixed investment in the United States has been higher than in Japan and West Germany.

The economic trends established in the 1970s and the culmination of these trends in the severe recession of 1981-82 produced a well-founded and deep-seated anxiety among Americans concerning the United States' economic future. The years since 1982 should have provided the economic tonic to dispel concern over American competitiveness in the global economy. Instead, for many analysts and policymakers, the shadow of the 1970s stretches long into the present and eclipses America's remarkable economic resurgence of the past 6 years.

Introduction

"America has lost its competitive edge in the world and now faces economic decline." That is the message of a recent barrage of reports purporting to demonstrate the existence of an American competitiveness problem.[1] The message is false. A few reports have demonstrated a turnaround in America's competitiveness. The New York Federal Reserve recently reports that "U.S. manufacturing has clearly become more competitive in recent years. This achievement was the result of sharp dollar depreciation, wage restraint, and strong improvements in U.S. productivity and quality performance."[2] The competitiveness crisis is an imagined problem rooted in the bygone economic stagnation of the 1970s and the period of severe economic recession that immediately followed in the early 1980s. These economic body blows left the nation reeling in self-doubt and highly susceptible to a doom-and-gloom prognosis. At the time the American economy hit bottom in 1982, the idea of a "competitiveness gap" fit the national mood perfectly. By 1985, "competitiveness" had become a national buzzword. Research on the so-called "competitiveness gap" developed into a growth industry among think tanks and the *cause celebri* of interest groups across the land. Despite this growing fascination with competitiveness, there continues to be great confusion over the concept's meaning.

The Concept of Competitiveness

On the one hand, economics is like baseball; each has a blue-zillion statistics, but performance in both boils down to a single datum -- in baseball, it is the won/lost record, in economics, it is the standard of living record. On the other hand, economics is very

much unlike baseball, in which one team wins at the other's expense. Economics is not a zero-sum game. To the contrary, free economies represent the ultimate cooperative social activity in which all may improve their plight without inflicting harm or privation upon others. Therefore, "competition" and "competitiveness" have quite different meanings in baseball and economics. Much of the problem with studies on American competitiveness results from a confusion between the two.

A competitive economy is one in which buyers and sellers, producers and consumers are free to maximize their wealth and satisfaction through commerce and trade. The material betterment of a nation's people made possible by the free conduct of commerce does not come at the expense of other nations. It is a mercantilist fallacy to label an economy "competitive" only to the extent that it outgrows or outsells or outproduces or outinvests or "outanythings" other nations.

The true measure of economic competitiveness is the extent to which an economic system is able to produce a rising standard of living for its citizens. What counts, therefore, is the level of economic well-being citizens enjoy and how rapidly that well-being is increasing relative to the past.

As in all human endeavors, it is natural to look for a measuring rod against which to judge success; in economics, that measuring rod is the performance of other economies. To the extent that such a comparison remains an analytical *means* to improve economic policy, it enhances economic growth. However, when improvement in the relative position of a nation on international rankings becomes an end in itself, the comparison ceases to have economic meaning or usefulness. Comparisons of this nature reflect the hot

emotions of envy more than the cool intellect of scientific comparisons. What results is a counterproductive political contest that may generate harmful mercantilist policies and ultimately depress the standard of living.

To evaluate America's competitiveness, one should measure the absolute standard of living at a point in time and chart the change in that absolute standard over time. Several additional indicators are useful to assist in monitoring the ability of the American economy to continue producing increases in the standard of living. One such indicator would chart the change in the American standard of living relative to that of other countries. In addition, factors that are important in achieving a high standard of living, such as productivity, investment, and research and development, should be examined as supplements to any aggregate indices that are constructed.

The Construction of Indicators

The most commonly used indicator for measuring the American standard of living is real per capita disposable personal income. This indicator shows the average income available for each person after adjusting for taxes and inflation.

When comparing the relative standard of living among different countries, the most commonly used measure is real per capita gross domestic product (GDP) converted into U.S. dollars by using exchange rates. There are, however, many problems with using exchange rates to convert the GDP data. For example, exchange rates reflect only the prices of goods and services that are traded internationally. Since most services are not traded internationally, the differences between the prices of non-traded goods and services among countries cannot be captured through changes in the exchange rate. In addition,

exchange rate movements often are determined by the decisions of monetary authorities of a group of nations; therefore, variations in the exchange rate frequently do not reflect the supply or demand of currencies determined by economic factors such as prices of goods. Regardless of the reason for a change in the exchange rate, such a change will produce a change in exchange-rate-converted GDP, even though the actual GDP remains unchanged.

In order to resolve these issues, purchasing power parity (PPP) exchange rates are introduced. PPP is defined as the ratio of one country's prices to another's for the same quantity of both traded and non-traded goods.[3] PPP exchange rates, which are expressed as units of foreign currency per U.S. dollar, represent the number of foreign currency units required to buy goods and services equivalent to what can be bought in the United States with one dollar. Thus, they are used to convert foreign GDP into a common denominator of U.S. dollars.

Some analysts argue for a different measure of the standard of living. The Council on Competitiveness proposes a standard of living index that is measured as GDP plus the current account balance, divided by the number of employed persons.[4] The rationale for including the current account balance is to "adjust each nation's total output for what is owed to foreigners." This definition of the standard of living is misleading and biased for three reasons. First, the established measure of the nation's output (GDP) is composed of personal consumption expenditures, plus gross private domestic investment, plus government purchases of goods and services. Then exports, which are produced but not consumed in the country, are added to the sum, and imports, which are consumed but

not produced in the country, are subtracted. Since net exports (exports minus imports) are a part of the current account balance,[5] adding the current account balance to GDP results in double counting.

Secondly, the use of total employment instead of population causes a bias when comparing the standards of living of different nations. The number of employees includes part-time workers as well as full-time workers. The United States has had the highest proportion of part-time employees relative to all employees in all G-7 countries[6] except the United Kingdom. For example, in 1986, the ratio of part-time employees to total employees in the United States was 17.4, compared to 11.7 in Japan, and 12.3 in West Germany.[7] Therefore, this usage would yield an undeserved lower standard of living for the United States, when compared to other countries, since part-time workers generally produce less than full-time workers. Moreover, such a measure is perverse. A country that has a lower employment-population ratio than another country, probably because of significant unemployment, can be interpreted as having a higher standard of living, even though the per capita GDPs of the two nations are about the same. Thus, a country is penalized for either having a higher proportion of part-time employees with respect to total employees or for having a higher employment-population ratio.

Thirdly, in addition to its technical flaws, the Council's measure is conceptually flawed. It commits the mercantilists' mistake of ignoring comparative advantage as the basis for trade patterns. With its index, the Council explicitly asserts that a country that strives for a current account surplus -- perhaps by erecting import barriers -- is by definition raising its standard of living. A country can also have a current account surplus

because of large interest and dividend earnings from investments abroad. West Germany, for example, has a large current account surplus that is partly attributable to heavy investment abroad. With a 9 percent unemployment rate, however, Germany might be better off if some capital outflows were instead channelled to domestic use and resulted in increased employment for German workers.

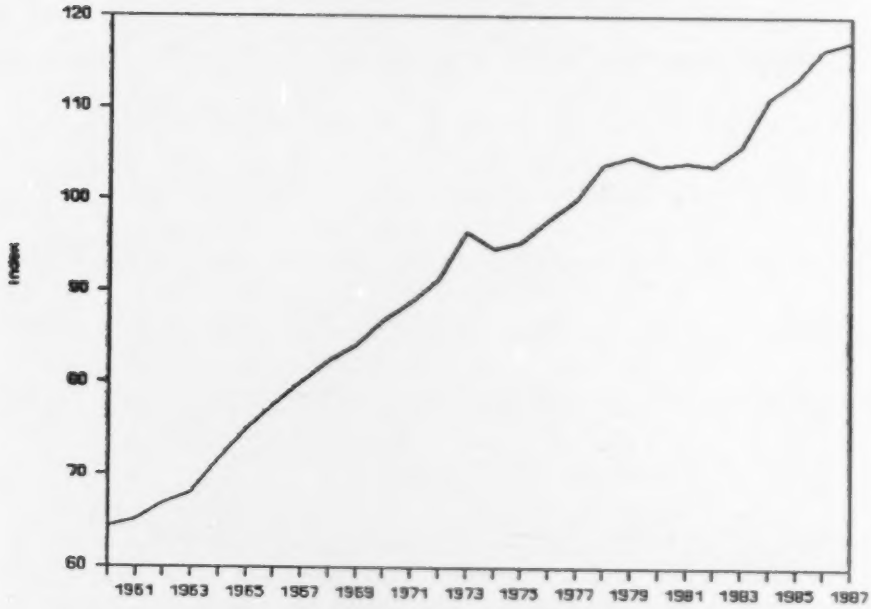
In addition to the above flaws in the definition, the Council on Competitiveness uses 1980 exchange rates to convert foreign data into U.S. dollars. No explanation is provided of why the 1980 exchange rate is superior to any other year to convert all the foreign data between 1970 and 1987. Yet, by selecting the 1980 exchange rate, the Council on Competitiveness grossly exaggerates the well-being of other countries in comparison to that of the United States, while portraying the U.S. economy in the worst possible light. The dollar exchange rate in 1980 was at its lowest before it rose to its peak in 1985, and then fell again until recently. In order to find the foreign nation's GDP in U.S. dollars, foreign exchange per dollar is used to divide a foreign nation's GDP. When the dollar is weak, it takes less foreign exchange to buy one dollar. A low dollar exchange rate means less foreign exchange per dollar. Since foreign exchange per dollar is the denominator, a smaller denominator yields a larger foreign GDP in terms of U.S. dollars. In other words, if the 1985 exchange rate were selected instead of the 1980 rate, the strong dollar would result in a much more favorable standard of living for the United States, because foreign currencies depreciated against the dollar by about 30 percent during the period 1980 to early 1985.

The U.S. Absolute Standard of Living Index

Real per capita disposable income grew steadily during the 1960s, then fell sharply in 1974 before rising again, only to stagnate between 1978 and 1982. After the 1981-82 recession, per capita disposable income began to rise steadily, reaching an all-time high in 1987. Between 1982 and 1987, real per capita disposable income rose at an average of 2.53 percent per year, compared to an average annual rate of 0.83 percent per year during the 1974 to 1982 period (see Chart 1).

CHART 1

Real Per Capita Disposable Income Index
(1977 = 100)



Source: Department of Commerce, Bureau of Economic Analysis & Bureau of the Census

Chart 1 shows the U.S. standard of living, measured by real per capita income after taxes, divided by the population. It shows per capita disposable income in 1982 dollars, indexed so that 1977 = 100.

Another measure of income is family income adjusted for the rate of inflation. Since 1982, real family income has increased by 11.8 percent. These recent increases have brought real family income to an all-time peak level, comparable to that of the previous peak in 1973, before a series of recessions resulted in substantial declines in real family income. The past 5 years of continuous growth in family income is the most sustained increase in 20 years.

The U.S. Absolute Standard of Living Versus Other Major Industrial Nations

Even though real output per capita (GDP) is not the most complete measure for the standard of living, it is the most commonly used indicator. While personal income is more relevant to the standard of living of a nation's citizens, the data on the income side of the national income account for other nations are not available. The published PPP exchange rate is used for converting only GDP, not for personal income; therefore, real GDP per capita is the only available measure for a comparison of international standards of living. Table 1 shows that the United States continues to enjoy the highest absolute standard of living in the world, including the Scandinavian countries, that are often thought to have the highest standard of living of all.

TABLE 1

Real Per Capita GDP in 1987
(In 1987 Dollars, PPP Exchange Rates)

Denmark	$13,240
Japan	13,198
Norway	15,563
Sweden	13,856
U.S.	18,289
W. Germany	13,349

Source: Bureau of Labor Statistics

While the rate of growth of the U.S. standard of living was slower than that of many industrial nations during the 1970s, a change in trends emerged recently. Between 1973 and 1982, the average annual growth rate of real per capita GDP in the United States was the lowest among the G-7 nations. From 1983 to 1987, however, the U.S. average annual growth rate was among the highest of these nations, only slightly lower than Japan's (see Table 2).

TABLE 2

Real Per Capita GDP
(Average Annual Rate Of Change)

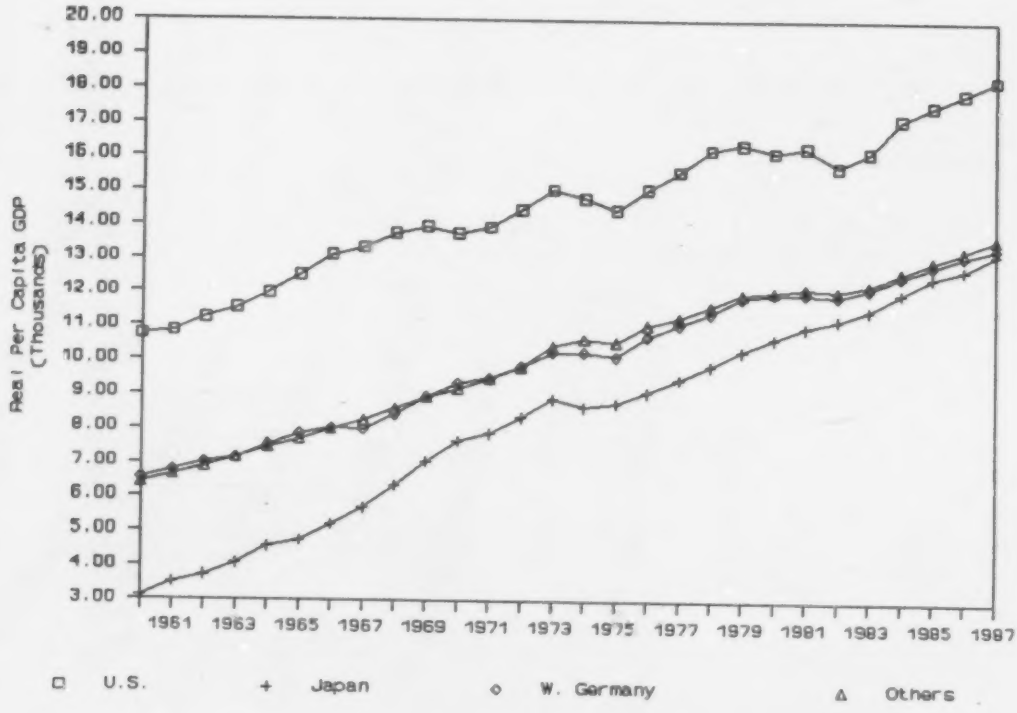
Country	1960-73	1974-82	1983-87
Canada	3.8	1.8	3.1
Japan	8.5	2.7	3.2
France	4.5	2.1	1.1
U.K.	2.6	0.8	3.0
U.S.	2.6	0.6	3.1
W. Germany	3.5	1.7	2.3

Source: Bureau of Labor Statistics

Even though most of the countries listed in Table 1 experienced a higher rate of growth in real per capita GDP after 1982, the U.S. performance showed the greatest improvement. In fact, the United States and the United Kingdom are the only two countries in which the recent average growth rates in real per capita GDP exceed their 1960-73 growth rates. And because of the outstanding performance in U.S. productivity and investment since 1982, the recent high growth rate of real per capita GDP still keeps the absolute real per capita GDP of the United States substantially higher than those of other G-7 nations (see Chart 2)

CHART 2

Real Per Capita GDP For the G-7 Nations



Source: Bureau of Labor Statistics, Office of Productivity and Technology, *Comparative Real Gross Domestic Product,* May 1988, (unpublished data). Each country's GDP is converted into U.S. dollars using the PPP exchange for total GDP.

Chart 2 shows per capita GDP in 1987 dollars for the G-7 nations. The real per capita GDP for the United States has been significantly higher than that of Japan, West Germany, and the average of Canada, France, Italy, and the United Kingdom.

The Relative Standard of Living Index

The relative standard of living index between the United States and other G-7 nations is constructed by dividing the U.S. real per capita GDP by the weighted average of the real per capita GDP of the other 6 of the G-7 nations, and then multiplying it by

100.[8] An index of 100 means the U.S. standard of living is about the same as the weighted average of the standard of living of those 6 nations. An index of more than 100 implies that the U.S. standard of living is higher than the average of the standards of living of the 6 nations. For example, if the index is 150, it means the U.S. standard of living is about 50 percent higher than the average of the 6 nations (see Chart 3).

CHART 3

Relative Standard Of Living Index

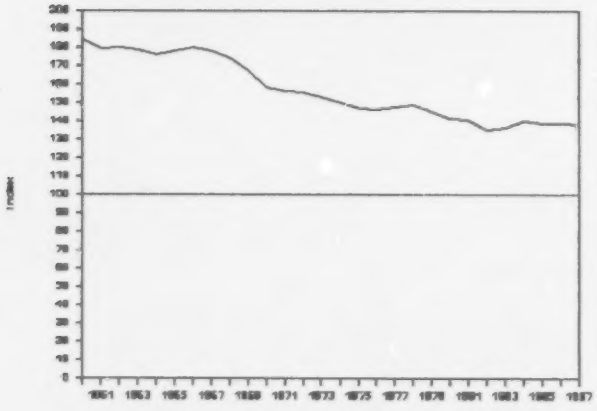


Chart 3 shows the relative standard of living index which was 184 in 1960, but eventually declined to its lowest point of 135 in 1982, before climbing to 138 in 1987. The relative index must be interpreted with great care. The decline in the index gives the inaccurate impression that U.S. performance is deteriorating while other countries are prospering. One reason for a decline in this index could be an absolute decline or a stagnation in the U.S. standard of living while other countries' living standards grow. Another reason for a decline in the index could be that the U.S. standard of living grows but those of other countries, many of which were destroyed by war less than 50 years ago, grow at faster rates. Since the latter, not the former, is the case, the "relative decline"

of the United States has been exaggerated.

Nonetheless, this notion of the "relative decline" of the United States has led many people to believe that the prosperity of our trading partners has diminished our own affluence and, therefore, to accept the alleged loss of U.S. competitiveness. In fact, the prosperity of our trading partners provides expanded trading and investment opportunity for the American people. It is a myth generated by the politics of envy, not by the law of economics, that one person or country creates wealth at the expense of another. The U.S. position always has been that American freedom and prosperity are most secure when other countries are prosperous and free. It is in our self-interest to seek a more prosperous world. Only when the world is viewed through the green-tinted lenses of envy, can we believe the economic good fortune of our allies bodes ill for America. Thus, we should not let unfounded fears lead us to misread the facts.

Factors Determining Competitiveness

There is no basis for accepting the alleged loss of U.S. competitiveness if we examine those variables that contribute to a country's competitiveness, such as manufacturing productivity, investment, and research and development.

Productivity

The most popular measure of productivity in the context of competitiveness is manufacturing output per hour. It is generally agreed that the United States still has the highest productivity in absolute terms. There are, however, no official government statistics on the subject. The problem with comparing the level of productivity for different countries is that there is no suitable exchange rate to convert the value of manufacturing output in each country's currency into dollars. Some analysts have attempted to compare the absolute level of manufacturing output per hour. For example,

the Council on Competitiveness uses PPP exchange rates to convert other G-7 nations' manufacturing output per hour into dollars. The flaw in this method is that PPP exchange rates, which are constructed for converting GDP only, are derived from the expenditure side of the national accounts (consumer, business, and government expenditure on final goods and services) and not from the output side of the account (gross product by industry). In fact, PPP exchange rates by industry are not available. Data Resources, Inc. constructed PPP exchange rates based on selected final expenditures by consumers and businesses to convert foreign currency data into U.S. dollars.[9] Although this method provides a better approximation of a PPP exchange rate for the manufacturing sector than the method used by the Council on Competitiveness, it still includes more than value added by manufacturing firms. To circumvent the problem of the appropriate PPP to use, the Bureau of Labor Statistics uses GDP per employed person as a proxy for productivity in comparing the absolute levels for different countries. According to this approach, the United States has the highest level of GDP per employed person (see Table 3).

TABLE 3

Real GDP Per Employed Person in 1987
(U.S. 1987 Dollars, PPP Exchange Rates)

Canada	$37,150
France	33,171
Japan	27,508
Italy	33,259
U.K.	27,982
U.S.	38,896
W. Germany	31,546

Source: Bureau of Labor Statistics

Compare to past performance, U.S. manufacturing productivity has improved dramatically during the 1980s (see Chart 4).

CHART 4

U.S. Productivity Index (1977 = 100)

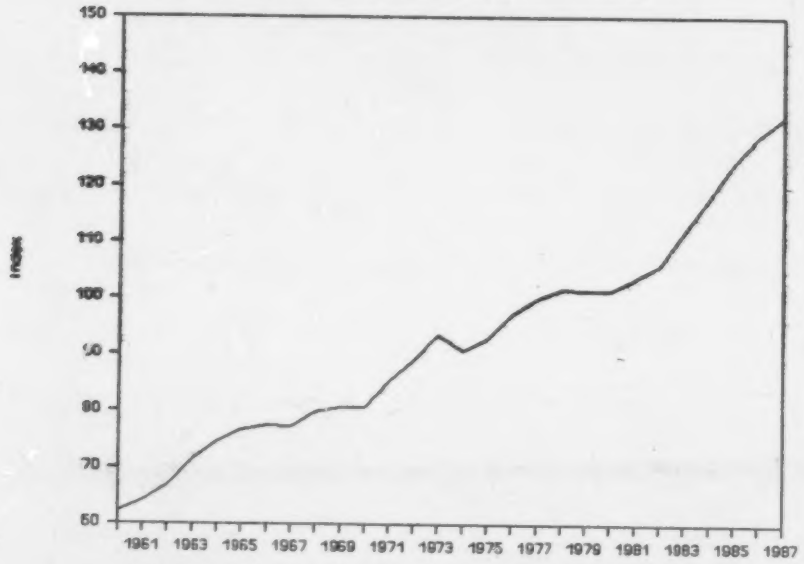


Chart 4 shows U.S. productivity measured by manufacturing output per hour, indexed so that 1977 = 100. The index has improved dramatically since 1982.

Since a reliable international level comparison of manufacturing output is not available, only trends or growth rates are compared. The average annual growth rate in manufacturing productivity tripled its rate over the 1970s, significantly outstripping productivity growth abroad; as a result, the actual level of U.S. manufacturing productivity has improved substantially over that of other major industrial countries (see Chart 5).

CHART 5

Manufacturing Output Per Hour
Average Annual Growth Rate

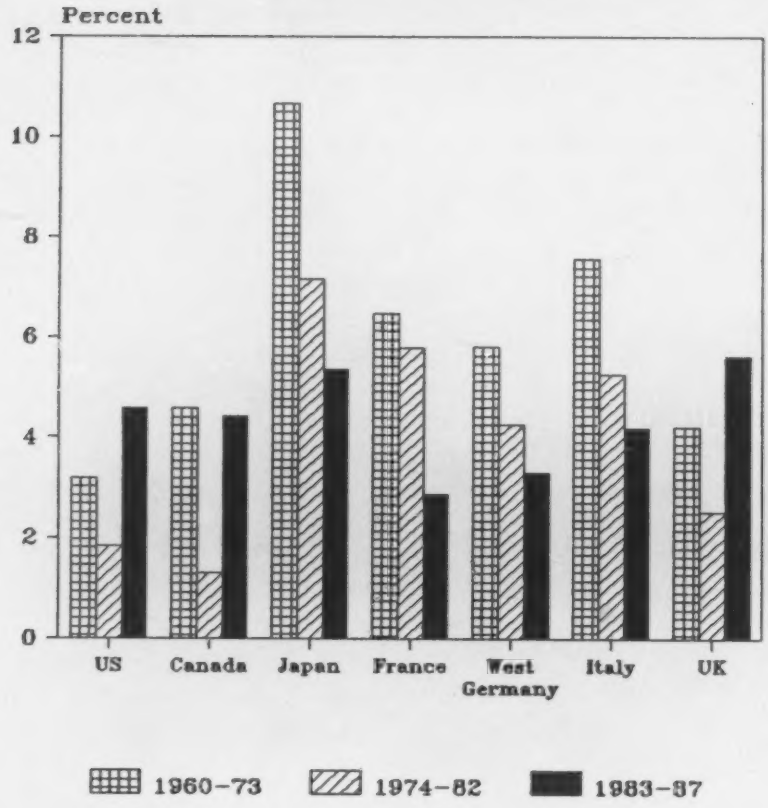


Chart 5 compares the average annual rate of growth in manufacturing productivity for the United States to that of other G-7 countries in 3 subperiods. The average annual rate of growth of U.S. manufacturing productivity was among the lowest in the G-7 countries at 1.84 percent during the 1974 to 1982 period. Between 1983 and 1987, however, the average growth rate in manufacturing productivity was among the highest of those countries at 4.57 percent. While other countries' growth rates of the recent period have been falling from the previous period, the growth rates of Canada, the United States, and

the United Kingdom have been increasing.

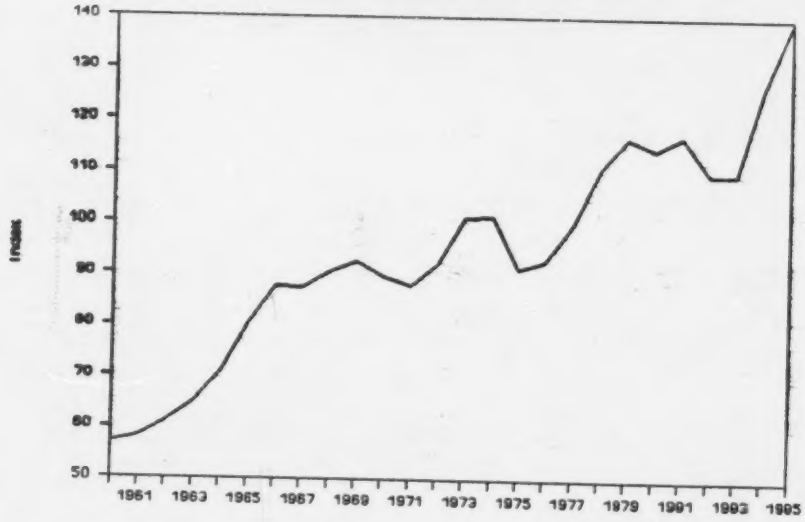
Investment

The U.S. investment outlook shows tremendous improvement and is more favorable than that of Japan and Europe. The variable usually observed is real nonresidential gross fixed capital formation (or nonresidential gross fixed investment) which is composed of real values of nonresidential construction and producers' durable goods. It shows how much new nonresidential investment, after adjusted for inflation, occurs during the year[10] (see Chart 6).

Chart 6 shows the index of nonresidential gross fixed capital formation in 1985 dollars from the years 1960 to 1985. Between 1983 and 1985, nonresidential gross fixed investment grew at an annual rate that was more than triple that of the 1973-82 period (1985 is the most recent year the data are available).[11]

CHART 6

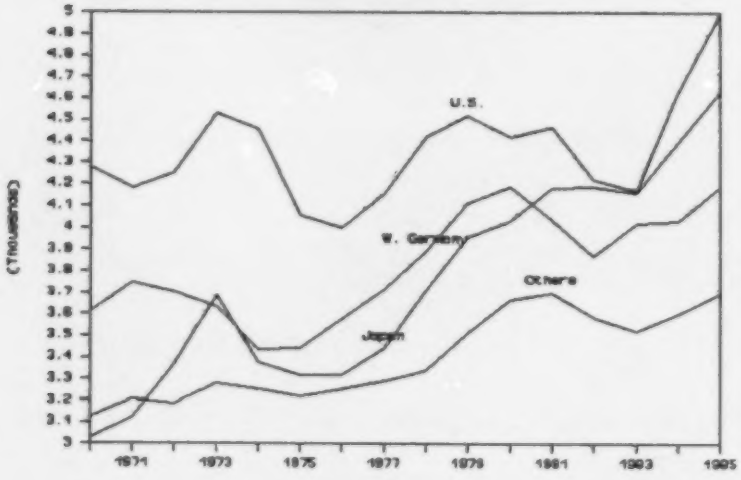
U.S. Nonresidential Gross Fixed Capital Formation
Index (1977 = 100)



For international comparisons of the level of investment, the levels of nonresidential gross fixed investment per worker are compared. In the United States, investment per employed person fell dramatically between 1974 and 1982. At the same time, investment per employed person in Japan continued to rise and leveled off close to the U.S. level in 1982. But between 1983 and 1985, the U.S. level rose sharply at about 5.9 percent per year, compared to 2.8 percent in Japan during the same period. Consequently, the U.S. level is still above Japan's, West Germany's, and the average of the rest of the G-7 countries (see Chart 7).

CHART 7

Nonresidential Gross Fixed Capital Formation Per Employed Person



Source: Bureau of Labor Statistics, Office of Productivity and Technology, *Real Gross Fixed Capital Formation (Excluding Residential Buildings)*, October 1987, (unpublished data). Each country's data are converted from its own currency to U.S. dollars by using the PPP exchange rate for capital formation.

Chart 7 shows nonresidential gross fixed capital formation per employed person, which is a proxy for the amount of capital available per worker, between 1970 and 1985

(not all data in all countries are available before 1970).

Research and Development

Research & development (R&D) also plays a role in determining productivity and quality performance. R&D expenditures are often reported as ratios of GNP. Some analysts argue that because of the relatively large size of the U.S. service and agricultural sectors, the ratio of R&D expenditures to GNP gives a downwardly biased impression of the U.S. research and development effort in manufacturing, the sector that is more crucial for competitiveness than the others.[12] A more suitable indicator suggested is the ratio of industrial research and development as a percentage of manufacturing sales. In 1979, this percentage was 1.51 for the United States, compared to 1.49 for Japan and 1.67 for West Germany. The U.S. percentage grew considerably during the 1980s, and has been higher than that of Japan and West Germany since 1982. In 1985, the U.S. percentage was 2.39, while percentages in Japan and West Germany were 2.24 and 1.99 respectively.

The National Science Board also reports that in the United States, R&D has enjoyed vigorous growth recently. Between 1980 and 1985, R&D expenditures in the United States increased by 74 percent, compared to 36 percent in West Germany, and 69 percent in Japan.[13] In 1986, R&D expenditures in constant dollars entered its 10th year of continuous expansion at a 5.9 percent increase over 1985. Therefore, the renewed R&D effort in the United States should continue to boost competitiveness in the future.

Conclusion

There is no basis to accept the alleged loss of U.S. competitiveness. Real per capita disposable income and median family income reached a record-high level in 1987. The American standard of living continues to be the highest in the world. American labor productivity in manufacturing improved dramatically during the 1980s. In recent years, the

investment outlook for plant, equipment, and producer durables has shown tremendous improvement, while investment in research and development has also enjoyed vigorous growth. Thus, the data do not suggest that in recent years, the United States has slipped either in absolute terms or relative to other countries. To the contrary, the data suggest that American competitiveness is resurgent, and that America indeed is entering a period of relative increase in its competitiveness.

Footnotes

[1] See for example, *Competitiveness Index*, Council on Competitiveness, 1988; *The Cuomo Commission Report*, The Cuomo Commission on Trade and Competitiveness, 1988; *Reassessing American Competitiveness*, National Planning Association on Changing International Realities, 1988.

[2] Susan Hickok, Linda A. Bell, and Janet Cegiowski, "The Competitiveness of U.S. Manufacturing Goods: Recent Changes and Prospects," Federal Reserve Bank of New York *Quarterly Review*, Spring 1988, pp. 7-22.

[3] The PPP exchange rates are calculated by the Organization for Economic Cooperation and Development (OECD) and the United Nations International Comparison Project (UNICP). Individual price surveys of a specified basket of goods and services of each country are compared to determine the PPP ratio for the year 1985. Using 1985 as the benchmark, the data are extrapolated to determine the PPP of other years.

[4] *Competitiveness Index*, Council on Competitiveness, 1988.

[5] The current account balance consists of balance on goods and services, income on foreign assets, government pensions, private remittances and other government and private transfers.

[6] The G-7 countries are the United States, Canada, Japan, France, Italy, and the United Kingdom.

[7] *OECD Employment Outlook*, September 1987, p. 28.

[8] The relative standard of living index is calculated by using the following formula:

$$\text{Relative Index} = (\text{U.S. per capita GDP}/\text{sum}(w^{*}\text{per capita GDP}_i))^{*}100,$$

where per capita GDP_i is per capita GDP of each of the six countries (Japan, Canada, France, West Germany, Italy, and the U.K.) and w is the weight of each of the six countries, determined by share of the country GDP, for example, weight of Japan is Japan's GDP divided by the sum of the GDPs of all the above six countries.

[9] Nigel Gault, "The Competitiveness of U.S. Manufacturing Industry: International Comparison of Labor, Energy, and Capital Costs," *Data Resources, Inc.*, 1985.

[10] No distinction is made between new investment for replacing old capital equipment and other new investment. In order to make any international comparisons of investment, the only PPP exchange rates that are available are for total capital formation.

[11] The Bureau of Labor Statistics is working on the revised and updated series.

[12] Susan Hickok, Linda A. Bell, and Janet Ceglowski, "The Competitiveness of U.S. Manufacturing Goods: Recent Changes and Prospects," Federal Reserve Bank of New York *Quarterly Review*, Spring 1988.

[13] *Science and Engineering Indicators,* National Science Board, 1987.